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Agricultural Memorandum No 922

LAND CAPABILITY CLASSIFICATION - A NEW APPROACH?
1. Climatic Limitations

by H A Douglas

I. Introduction

Agricultural land classification is required as an aid to determining optimum land use for agricultural advisory and land planning purposes. The classification ranks land on the basis of its potential productivity and cropping flexibility by taking into account several limiting factors (gradient, soil texture, climate, etc). A further stage in the development, not yet attempted on a national scale, is to include other (economic) factors in an assessment of suitability for particular crops.

For a number of years there have been two systems operating in England and Wales with a further system in Scotland. All three systems had similarities in approach, but each could result in a different assessment for a given site. A Working Party of Soil Scientists was established in 1975 to consider a review of the systems with the aim of establishing a common scheme. The Meteorological Office were asked to join the Group in late 1976.

The Working Party has now completed its review and the official guidelines will appear as a Technical Monograph, probably early in 1982. From that date it will be the only system applicable in England and Wales, whilst in Scotland a system similar in approach has been adopted.

This note reproduces the final draft of the section on climatic limitations and comments on the factors chosen. A second paper will describe the meteorological components of the other limiting factors (e.g. droughtiness, trafficability, etc), and a third will discuss the mapping criteria selected and the likely errors.

II. THE DRAFT

Climatic Limitations

Climate is a vital factor in assessing the capability of any area of land. Its various components influence agricultural activities directly, through the effect of weather on stock or on the above-ground parts of plants, and indirectly through an interaction with soil properties affecting water and nutrient supplies to the plant root and also cultivation practices. To aid description the climatic limitation is strictly restricted to direct influences. Indirect effects which are interactive and strongly modified by soil factors are treated under other limiting factors (e.g. wetness and droughtiness).

Climate is variable over the years but its resultant effect on agriculture depends also on recently introduced crop varieties and agricultural practices. It is therefore important to establish the climatic limitations and assessment on a sound scientific basis so that future changes in capability (defined by cropping practice) due to changes in climate or technology can be distinguished.

There are many parameters which can be used to describe the varying conditions and the adopted approach continues that initiated by Birse (Birse 1970a, b, 1971a, b) for Scotland and later adopted in a modified form for England and Wales (Bendelow and Hartnup 1977, 1980). The approach uses a two parameter (accumulated temperature and maximum soil moisture deficit) array classification modified, where it affects cropping selection, by consideration of exposure to high wind speeds.

So that data from one or two exceptional years does not bias the data, the practice of using median and quartile values has been introduced. Although the data used to verify the classification system is based, for technical reasons, on the 20-year period 1959-78 (except wind which was for 1965-73), data from other sources need not be converted to the same period before use, provided the original data is both recent (generally since 1940) and for a period of not less than 15 years (10 for wind).

Climate is highly dependent on local topographic variations and care must be exercised when interpreting data from stations other than at the site in question. The Regional Agricultural Meteorologist can advise on the suitability of records for comparison, the availability of other unpublished data and local interpretations.

Maximum Potential Soil Moisture Deficit (Max PSMD)

This is the theoretical deficit achievable under short grass which completely covers the ground, in which the soil is assumed to have a large store of water, and hence crop transpiration is unrestricted (MAFF 1971). The deficit represents a balance between rainfall and evaporation, calculated on a daily basis. It is the maximum value of the deficit rather than the date of occurrence which is considered important for general climate classification, although the period of deficit will be important for detailed studies and for other factors (e.g. trafficability). The median value of the maximum deficit is used in this classification scheme (see below).

The median values for 157 sites have been calculated and are given in Table 1. Isopleths of equal values of maximum PSMD are shown on a map prepared by the Meteorological Office (in hand - due to be printed late 1982). Values of PSMD can vary over short distances, and care must be exercised in selecting the appropriate value. When selecting a value it is more important to base the selection on similarity in rainfall characteristics between sites (altitude and position relative to hill ranges) than on proximity alone.

Accumulated Temperature

In any climatic assessment for land classification, there must be a factor to represent the availability of energy (from direct radiation). Since detailed radiation information is only available for a very limited number of sites, all classifications are based on some derivative of temperature. It has previously been assumed that growth starts at a temperature around 5.6°C or 6°C and these values have been used as thresholds for several classification schemes. Recent work (Peacock 1975, 1976, Biscoe and Gallagher 1978) has shown, however, that grass and cereals maintain leaf growth, albeit slowly, down to 0°C and this has been taken as the base value for this classification. Previous temperature classifications have used sums over the entire year, or through a notional growing season. Recent work (Waring and Cooper 1971) indicates that, over a wide range of crops, temperature is most important during leaf growth and that high temperatures in late summer can adversely affect yields. As leaf growth occurs at slightly differing times of the year in different parts of the country, the final parameter selected for this classification is the lower quartile value of accumulated temperature above 0°C over the first six months of the year (i.e. January-June, inclusive).

As with moisture deficit, actual data should always be used (data and details for stations are given in Table 1) in preference to interpolated or estimated values. Values can be estimated from the map prepared by the Meteorological Office (in hand - due to be printed mid-1982).

Further consideration must be given in the final analysis to local effects such as hollows, additional shelter, south-facing slopes. It is not possible to quantify these factors on a national scale, but an assessment of their likely effects should be made and marginal classifications adjusted accordingly.

Guidelines for Classification

The appropriate maximum PSMD and accumulated temperature values are combined in Figure 1. The classification indicated by this method is the highest possible, based only on climatic factors.

In general, the temperature (energy supply) dominates for low values of accumulated temperature (higher altitudes or more northerly latitudes), whereas soil moisture deficit dominates elsewhere. It should be noted that the position within a classification band is as important as the band itself when comparisons between sites are being made. Thus Durham (code 85) and Keele (183) can expect to have more similarities with each other than either have with Montrose (26). Areas which are hatched are not normally represented anywhere in the British Isles.

Modification due to Exposure (Wind Speed)

It is known that consistent high winds reduce the capability (in particular the range of crops) of an area of land, but a detailed relationship has not been established. In view of this and the fact that detailed wind speed measurements are only known for a limited number of sites, the adopted approach attempts to draw attention to areas where special attention should be paid to this factor, rather than providing a rigid interpretation.

Figure 2 illustrates the distribution of the isopleths of median wind speed over open country and for low altitudes (below 70 metres). An accurate adjustment for high altitude is not possible, but approximate guidance can be obtained by increasing the indicated speed by 7%, for each 100 metre increase in altitude above 70 metres. Local topographic features may further increase or decrease this value.

If, after any necessary adjustment, the site lies in an area where the median wind speed exceeds 5 metres per second (ms^{-1}), serious consideration should be given to the possibility of downgrading. Before downgrading, evidence would be required that the range of successful crops is limited compared with that of a site with similar climatic classification but experiencing less wind. It is expected that downgrading will be likely for median speeds above 5.5 ms^{-1} and probable for median wind speeds above 6.0 ms^{-1}, but because exposure is a limitation on cropping, downgrading will only take place where the original classification is 3 or higher.

As with all factors, the divisions across the thresholds are not sharp and downgrading due to exposure should only take place where there is supporting evidence. The Regional Agricultural Meteorologist, as with soil moisture and temperature values, may be able to provide further guidance on local factors or availability of data.

III. Discussion on contents

It is important to realise that the Working Party had, from the beginning, an almost impossible task in that it was not possible to replace 3 classification systems by a single system without some resultant changes in classification. This was particularly

the case with the climatic criteria, which differed considerably between the previous approaches. The proposed scheme sets out a scientifically-based national approach, which can be used for both large and small-scale surveys and which appears consistent with current cropping practice. It will necessitate changes (some small, some large) from previous classifications - if climate alone is considered, although it is believed that in most areas other factors will now become limiting and the overall classification remain as before. The selected approach was also chosen because it offerred a basis for developing suitability criteria.

It is also important to realise that the classification is based on capability, not suitability or actual cropping, and that it is a national scheme. Thus land is not only compared with other local areas but is considered on a much wider basis. During the period of the Working Party there was good evidence that land (similar in all respects, including climate, as defined here) in Scotland was more intensively worked than corresponding land in, say, the south-west of England. Thus it can be expected that land will appear to be upgraded (especially marginal upland areas) as a result, especially towards the south-west. This implies a higher capability; but for economic or other reasons, e.g. proximity of suitable land, it may not be appropriate to work to the maximum capability.

It can be argued that the two main parameters selected (max PSMD) and accumulated temperature are not the most appropriate. Individual examples can always be found which support an alternative choice; but the need for a single national criteria and the strict restriction on what could be included in the climate section (see first paragraph of text) effectively limit the choice. Where measurements are made at a site, precise allocation to a classification is possible. For other areas, it should be noted that no formal guidance, other than use of the maps and reference to the Regional Agricultural Meteorologist is given. Once the maps are published, they will be considered the definitive source of information until replaced.

However these maps, must of necessity, assume the area is flat and featureless and the meteorologists may well be asked to provide local guidance to allow for, say, a south-facing slope.

As an interim measure - until the maps are prepared, the regressions (linear regressions giving least $\sum(\text{difference})^2$) listed in Table 2 can be used. Use can also be made of other locally available data if required to undertake detailed work. Other approaches (than the regressions) are currently being investigated to find the most suitable for the preparation of the maps.

Table 1 and Figure 3 of this paper will form part of the Appendix of the Technical Monograph.

Acknowledgements

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Any comments on this should be made direct to the author.

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References

Bendelow V C and R Hartnup 1977 The assessment of climatic limitations in land use capability classification. North of England Soils Discussion Group Proceedings 13, pp 19-28.

Bendelow V C and R Hartnup 1980 Climatic Classification of England and Wales. Soil Survey Tech Mono no 15.

Birse E L 1971 (a) Assessment of Climatic Conditions in Scotland. 3. The Bioclimatic Sub-Regions. Macaulay Institute for Soil Research, Aberdeen.

Birse E L 1971 (b) Climatic Assessment and Land Use Capability. Practical Applications of Soil Survey. Proceedings of the Stirling Field Meeting. Macaulay Institute for Soil Research, Aberdeen.

Birse E L and F T Dry 1970 (a) Assessment of Climatic Conditions in Scotland. 1. Based on Accumulated Temperature and Potential Water Deficit. Macaulay Institute for Soil Research, Aberdeen.

Birse E L and L Robertson 1970 (b) Assessment of Climatic Conditions in Scotland. 2. Based on Exposure and Accumulated Frost. Macaulay Institute for Soil Research, Aberdeen.

Biscoe P V and J N Gallagher 1978 A Physiological Analysis of Cereal Yield 1. Production of Dry Matter. Agric Prog 53, pp 34-50.

MAFF 1971 The significance of Winter Rainfall over farmland in England and Wales. Tech Bull No 24. MAFF. London.

Peacock J M 1975 Temperature and leaf growth in Lolium Perenne. II The site of temperature perception. J Appl Ecol 12, pp 115-123.

Peacock J M 1976 Temperature and leaf growth in Lolium Perenne. III Factors affecting seasonal differences. J Appl Ecol 12, pp 685-697.

Waring P F and P J Cooper 1971 (Eds) Potential Crop Production. Heinemann.

Table 1 Accumulated temperature, potential soil moisture deficit and site information for selected stations

Station	Grid Reference	Altitude (m)	Lower Quartile Value of Acc Temp	Median Value* of Max PSMD	Stations* plotted on Figure 1	Key for Figure 3
Lerwick	N41/453397	82	954	77	1	1
Baltasound	N42/607089	24	1001	-	-	2
Kirkwall	N30/483076	26	1073	73	3	3
Wick	39/364522	36	1066	109	4	4
Strathy	29/830609	38	1067	79	5	5
Lairg	29/576071	94	1051	95	6	6
Fortrose	28/749557	5	1207	-	-	7
Geanies House	28/895793	61	-	120	-	8
Fasnakyle	28/314288	80	-	97	-	9
Bhlaraidh	28/382165	70	-	97	-	10
Fort Augustus	28/381091	21	1199	(97)	(11)	11
Inverness	28/668462	4	1246	118	12	12
Nairn	28/869568	6	1153	155	13	13
Banff	38/689647	24	1217	-	-	14
Craibstone	38/871107	102	1071	108	15	15
Braemar	37/152914	339	914	111	16	16
Balmoral	37/260946	283	917	-	-	17
Glenmore Lodge	28/986095	341	939	-	-	18
Glenlivet	38/188303	215	1027	-	-	19
Banchory	37/692959	94	1165	(106)	(20)	20
Dinnet	38/446025	177	1084	-	-	21
Fyvie Castle	38/766392	55	1098	-	-	22
Invery House	37/698940	69	-	106	-	23
Whitehillocks	37/448800	258	991	-	-	24
Fettercairn	37/669782	171	1032	-	-	25
Montrose	37/707617	57	1126	138	26	26
Faskally	27/918599	94	1163	111	27	27
Ardtalnaig	27/702394	130	1189	91	28	28
Strathearn	27/867223	122	-	100	-	29
Glamis Castle	37/388486	61	1098	98	30	30

*The use of brackets indicates that a nearby value for max PSMD has been used.

Station	Grid Reference	Altitude (m)	Lower Quartile Value of Acc Temp	Median Value* of Max PSMD	Stations* plotted on Figure 1	Key for Figure 3
Mylnefield	37/339301	30	1201	-	-	31
Leuchars	37/468209	10	1175	148	32	32
Loch Leven	36/171994	110	-	112	-	33
Bridge of Allan	26/792974	12	-	98	-	34
Turnhouse	36/159739	35	1237	-	-	35
Bush House	36/244636	184	1089	-	-	36
Haddington	36/513736	49	1219	166	37	37
Dunbar	36/672791	23	1235	-	-	38
Gladhouse Reservoir	36/299544	279	-	107	-	39
Glentress	36/283397	165	1132	110	40	40
Bowhill	36/428278	168	1137	118	41	41
Eskdalemuir	36/235026	242	1045	57	42	42
Whitchester	36/721589	255	1022	-	-	43
Marchmont	36/743484	152	1125	-	-	44
Lochmore Lodge	29/300386	46	-	36	-	45
Inverpolly	29/074134	14	1252	55	46	46
Stornoway	19/464332	15	1179	90	47	47
Prabost	18/418501	67	1193	(60)	(48)	48
Duntulm	18/399718	90	-	60	-	49
Kinlochewe	28/024630	23	1232	49	50	50
Benbecula	08/782556	6	1265	78	51	51
Tiree	07/999446	9	1311	105	52	52
Rhubana	17/688922	16	-	54	-	53
Achnashellach	28/038492	67	1189	-	-	54
Fort William	27/123759	8	1303	54	55	55
Onich	27/028630	15	1275	-	-	56
Mull	17/564455	3	1262	72	57	57
Crarae Lodge	16/986973	6	-	51	-	58
Eallabus	16/335634	21	-	79	-	59
Ormsary Lodge	16/739718	15	-	80	-	60

*The use of brackets indicates that a nearby value for max PSMD has been used.

Station	Grid Reference	Altitude (m)	Lower Quartile Value of Acc Temp	Median Value* of Max PSMD	Stations* plotted on Figure 1	Key for Figure 3
Benmore (YBG)	26/141856	12	1250	56	61	61
Greenock	26/274757	61	-	82	-	62
Abbotsinch	26/480667	5	1301	131	63	63
Glasgow (Sp Park)	26/608686	107	1223	95	64	64
Coatbridge	26/714643	66	1236	-	-	65
Townhill Reservoir	26/694546	131	-	104	-	66
Rothesay	26/083649	43	1323	-	-	67
Munnoch Reservoir	26/254481	99	-	92	-	68
Kype Reservoir	26/735387	287	-	72	-	69
Prestwick	26/369261	16	1279	128	70	70
Auchincruive	26/389236	45	1284	(128)	(71)	71
Girvan	25/184979	8	1407	-	-	72
Euchan Filters	26/729070	280	-	61	-	73
Bargrennan	25/361789	110	1163	70	74	74
Penwhirn	25/127693	166	1078	-	-	75
Stranraer	25/037619	64	-	100	-	76
Threave	25/751607	73	1219	100	77	77
Palnure	25/452646	18	1246	-	-	78
Dundeugh	25/598879	119	1125	-	-	79
Dumfries	25/982747	49	1249	107	80	80
Keilder Castle	35/632935	201	1024	74	81	81
Lilburn	46/026243	70	-	103	-	82
Cockle Park	45/200912	99	1135	-	-	83
Tynemouth	45/374695	30	1244	136	84	84
Durham	45/267415	102	1232	125	85	85
Tunstall	45/063407	221	-	107	-	86
Hartlepool	45/510327	9	1324	-	-	87
Haydon Bridge	35/838645	79	1231	-	-	88
Moor House	35/758328	556	677	-	-	89
Appleby	35/684198	146	-	117	-	90

* The use of brackets indicates that a nearby value for max PSMD has been used.

Station	Grid Reference	Altitude (m)	Lower Quartile Value of Acc Temp	Median Value* of Max PSMD	Stations* plotted on Figure 1	Key for Figure 3
Silpho Moor	44/957946	203	1099	-	-	91
Thirsk	44/438818	35	-	154	-	92
Pickering	44/795842	44	1239	152	93	93
Birdsall House	44/819650	94	-	142	-	94
High Mowthorpe	44/888685	175	1106	-	-	95
York	44/581527	9	-	156	-	96
Cawood	44/561372	6	1291	(156)	(97)	97
Bradford	44/149352	113	1253	113	98	98
Goole	44/745235	169	-	169	-	99
Pontefract	44/453211	78	1307	187	100	100
Huddersfield Oaker	44/113177	232	1229	113	101	101
Brigg	44/987062	5	-	175	-	102
Bridlington	54/172687	48	1183	-	-	103
Hull	54/083301	2	1409	177	104	104
Finningley	43/659989	10	-	208	-	105
Sheffield	43/339873	131	1343	132	106	106
Buxton	43/058734	307	1083	82	107	107
Waddington	43/988653	68	1314	-	-	108
Warsop	43/591699	46	1295	(151)	(109)	109
Mansfield	43/543613	110	-	141	-	110
Whatstandwell	43/326554	75	-	118	-	111
Basford	43/565429	51	-	151	-	112
Nottingham	43/569395	59	1431	154	113	113
Waltham	43/804251	174	-	162	-	114
Shobnall	43/234231	48	-	168	-	115
Newton Linford	43/530095	119	1297	(147)	(116)	116
Thornton Reservoir	43/473072	112	-	147	-	117
Hagworthingham	53/354691	62	-	174	-	118
Skegness	53/569631	5	1341	-	-	119
Cranwell	53/004393	62	1290	203	120	120

*The use of brackets indicates that a nearby value for max PSMD has been used.

Station	Grid Reference	Altitude (m)	Lower Quartile Value of Acc Temp	Median Value* of Max PSMD	Stations*plotted on Figure 1	Key for Figure 3
Boston	53/323450	3	-	196	-	121
Sandringham	53/697287	37	-	160	-	122
Marham	53/726094	23	1395	(160)	(123)	123
Wittering	53/043026	73	-	212	-	124
Cromer	63/208422	54	1348	211	125	125
Gorleston	63/529037	4	1337	(226)	(126)	126
Caldecott	42/865932	53	1307	-	-	127
Edgbaston	42/046864	163	1325	145	128	128
Rugby	42/507749	117	1349	(161)	(129)	129
Ravensthorpe	42/682704	98	-	161	-	130
Ashdale	42/306577	46	-	182	-	131
Wellesbourne	42/271565	47	1341	(182)	(132)	132
Woburn	42/964360	89	1336	197	133	133
Aylesbury	42/841115	96	1403	192	134	134
Oxford	42/509092	63	1477	177	135	135
Brize Norton	42/289060	84	-	183	-	136
March	52/421967	2	-	212	-	137
Santon Downham	52/813901	24	1307	176	138	138
Wyton	52/284745	40	1394	-	-	139
Cambridge (NIAB)	52/434604	24	1413	(237)	(140)	140
Cambridge (Bot Gar)	52/456572	12	-	237	-	141
Felsted	52/676205	73	-	208	-	142
Rothamsted	52/132134	128	1324	176	143	143
Writtle	52/677066	35	1411	(208)	(144)	144
Lowestoft	62/543946	25	-	226	-	145
Wattisham	62/026514	89	1321	(224)	(146)	146
Belstead Hall	62/127411	38	-	224	-	147
Hurley	41/823829	43	1429	(212)	(148)	148
Taplow	41/907821	65	-	212	-	149
Shinfield	41/729684	62	-	185	-	150

*The use of brackets indicates that a nearby value for max PSMD has been used.

Station	Grid Reference	Altitude (m)	Lower Quartile Value of Acc Temp	Median Value* of Max PSMD	Stations* plotted on Figure 1	Key for Figure 3
South Farnborough	41/867548	69	1445	188	151	151
Boscombe Down	41/172403	126	1377	197	152	152
Leckford	41/393362	117	1369	-	-	153
Martyr Worthy	41/517338	84	1383	190	154	154
Fernhurst	41/908267	57	1405	(156)	(155)	155
West Dean Park	41/864127	58	-	156	-	156
Brockenhurst	41/311028	12	-	183	-	157
Everton	40/302937	16	1503	-	-	158
Southsea	40/637991	2	-	210	-	159
Ryde	40/597928	4	1569	232	160	160
St Catherine's Poirt	40/498753	16	1462	229	161	161
Mickleham	51/173527	55	1378	-	-	162
Maidstone	51/759561	15	-	235	-	163
Falconhurst	51/470426	110	-	189	-	164
Goudhurst	51/722333	85	1382	-	-	165
Worthing	51/160035	2	-	198	-	166
Hastings	51/809094	45	1481	197	167	167
Manston	61/335666	44	1429	238	168	168
Faversham	61/007593	48	1404	-	-	169
Dover	61/320410	6	1316	200	170	170
Brookfield	35/242478	34	-	118	-	171
Newton Rigg	35/493310	171	1203	-	-	172
Sellafield	35/027032	13	1329	112	173	173
Malharm Tarn	34/894672	403	917	73	174	174
Morecambe	34/431645	7	1417	126	175	175
Kirkham	34/414346	24	1329	-	-	176
Squire's Gate	34/316316	10	1363	172	177	177
Bolton	34/724116	107	1295	-	-	178
Heaton	34/637096	152	-	95	-	179
Knot Hill	34/958014	184	-	104	-	180

*The use of brackets indicates that a nearby value for max PSMD has been used.

Station	Grid Reference	Altitude (m)	Lower Quartile Value of Acc Temp	Median Value* of Max PSMD	Stations* plotted on Figure 1	Key for Figure 3
Llwydiarth	23/436843	61	-	126	-	181
Valley	23/309757	10	1483	-	-	182
Colwyn Bay	23/860787	24	1459	153	183	183
Alwen	23/957529	335	999	-	-	184
Botwnog	23/263313	34	1429	117	185	185
Bidston	33/287899	60	1409	153	186	186
Prestatyn	33/061836	4	1473	-	-	187
West Kirby Park	33/216865	7	1488	-	-	188
Lostock Gralam	33/682743	23	-	115	-	189
Hawarden Bridge	33/314694	5	1474	141	190	190
Bwlchgwyn	33/236520	386	1009	-	-	191
Wrexham	33/305479	113	-	147	-	192
Keele	33/820446	179	1211	128	193	193
Shawbury	33/553220	72	1339	166	194	194
Milford	33/975212	75	-	152	-	195
Lake Vyrnwy	33/017188	303	1071	80	196	196
Shrewsbury	33/517136	55	1378	-	-	197
Penkridge	33/920116	101	1241	-	-	198
Lelterston	12/975325	119	-	101	-	199
Aberdovey	22/621963	52	-	95	-	200
Gogerddan	22/627835	31	1413	92	201	201
Aberystwyth	22/584814	4	1418	-	-	202
Bwlch-y-Graig	22/579595	241	-	79	-	203
Aberporth	22/242521	133	1363	-	-	204
Abergorlech	22/585336	76	-	78	-	205
Church Stretton	32/438911	187	-	131	-	206
Oakley Park	32/491762	91	-	162	-	207
Bluith Wells	32/061605	235	-	104	-	208
Lyonshall	32/339576	155	1347	-	-	209
Malvern	32/790461	62	1471	173	210	210

*The use of brackets indicates that a nearby value for max PSMD has been used.

Station	Grid Reference	Altitude (m)	Lower Quartile Value of Acc Temp	Median Value* of Max PSMD	Stations* plotted on Figure 1	Key for Figure 3
Llangrosser	32/287380	343	-	131	-	211
Cheltenham	32/946218	65	1463	159	212	212
Penmaen	21/531889	87	1449	120	213	213
Mumble's Head	21/627870	35	1441	-	-	214
Hawkridge	21/877327	314	1166	-	-	215
Hartland Point	21/231276	95	1447	-	-	216
South Molton	21/716256	131	-	108	-	217
Bude	21/208063	15	1533	150	218	218
Filton	31/600805	59	-	169	-	219
Wroughton	41/151802	137	-	161	-	220
Cardiff (Rhoose)	31/064679	67	1415	145	221	221
Long Ashton	31/535699	51	1477	(169)	(222)	222
Millfield	31/492362	30	-	169	-	223
Taunton	31/229238	22	-	216	-	224
Rosewarne	10/643412	76	1544	-	-	225
Penzance	10/469302	19	1658	123	226	226
Swincombe	20/633719	317	-	83	-	227
St Austell	20/018525	94	1571	128	228	228
Plymouth	20/492529	27	1575	-	-	229
Exeter	30/001933	32	1515	192	230	230
Sidmouth	30/124873	10	1511	(192)	(231)	231
Wareham	30/911823	69	-	189	-	232
Scilly Isles	00/913121	51	1707	177	-	233

Note: Care must be taken when applying the above data to areas other than where the measurements were made, to make sure that the data is representiatve (e.g. not using an urban site for a non-urban area without modification). In cases of doubt you should contact your Regional Agricultural Meteorologist.

*The use of brackets indicates that a nearby value for max PSMD has been used.

Table 2(a) Regression equations for calculating the value of 1st quartile of accumulated temperature above 0°C for January-June based on the mean temperature for the month.

Equation A = a + bT where A = 1st quartile of accumulated temperature above 0°C
T = mean temperature (°C)
both for period January-June combined

	a	b
Area 1	148.7	152.2
Area 2	-15.3	177.8
Area 3	83.8	167.7
Area 4	-92.9	185.1
Area 5	65.3	166.7
Area 6	241.5	139.7
Area 7	135.0	158.1
Area 8	-135.5	194.6
All Areas	108.6	161.0
All Areas except 4, 6 and 8	79.3	164.6

Use the appropriate values for the area after reference to Figure 4.

Table 2(b) Regression equations for calculation of accumulated temperature above 0°C (Jan-Jun) from accumulated temperature above 5.6°C and of maximum potential water deficit from potential water deficit (Birse and Dry 1970) and moisture deficit (Bendelow and Hartnup 1980).

Accumulated Temperature

The regression equation takes the form of $y = ax + b$ where
y = accumulated temperature above 0°C (Jan-Jun)
x = accumulated temperature above 5.6°C, and the co-efficients are listed for each of the areas in Figure 4.

Area	1	2	3	4	5	6	7	8
a	0.605	.589	.755	.599	.570	.693	.609	.590
b	334	314	29	333	354	206	341	418

Soil Moisture

The regression equations to convert MD and PWD to MAX, PSMD are of the form $y = ax + b$ where
y = maximum potential soil moisture deficit (PSMD) (mm)
and x = PWD or MD as appropriate.

For MD (valid for England and Wales)
$a = 0.97$ and $b = 29$

For PWD (valid for Scotland)
$a = 0.81$ and $b = 64$.

Note: As with all regressions, actual values are always to be preferred to any value from a regression equation.

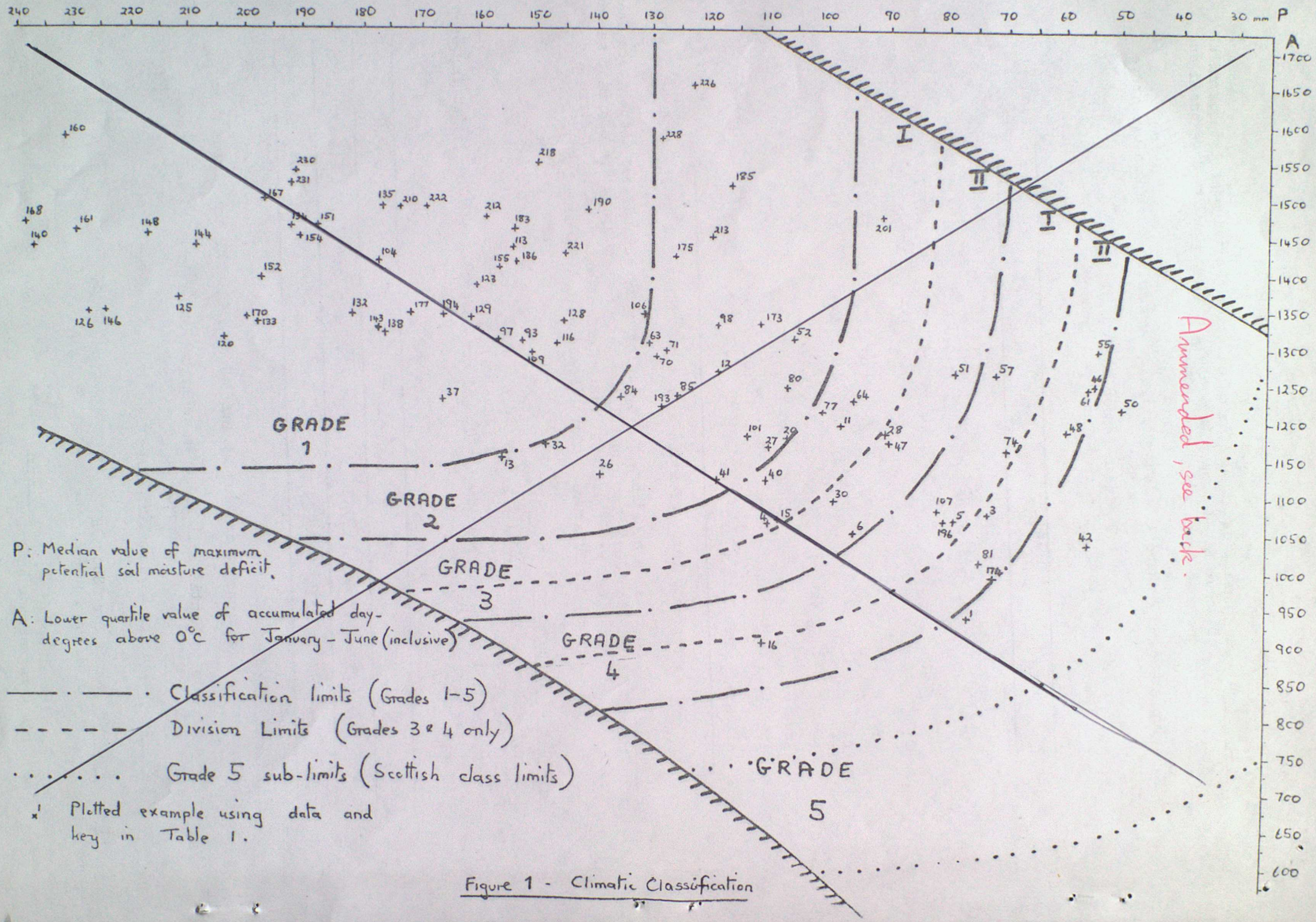

240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 mm P
A
1700 1650 1600 1550 1500 1450 1400 1350 1300 1250 1200 1150 1100 1050 1000 950 900 850 800 750 700 650 600
GRADE 1
GRADE 2
GRADE 3
GRADE 4
GRADE 5
I
II
I
II
Annuended, see back.
P: Median value of maximum potential soil moisture deficit.
A: Lower quartile value of accumulated day-degrees above 0°C for January - June (inclusive)
Classification limits (Grades 1-5)
Division Limits (Grades 3 & 4 only)
Grade 5 sub-limits (Scottish class limits)
x' Plotted example using data and key in Table 1.

Figure 1 - Climatic Classification

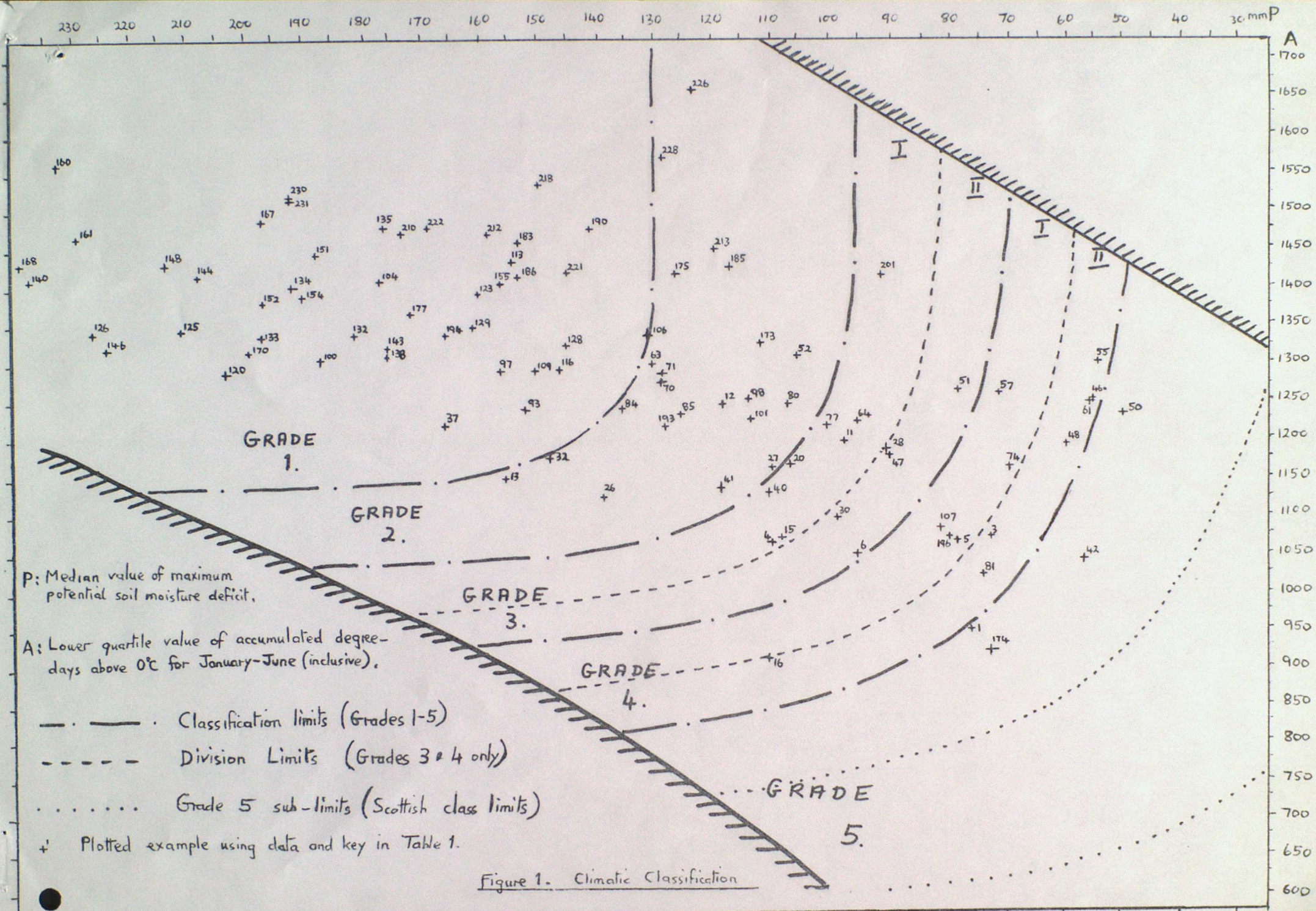

P
mm
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30
A
1700 1650 1600 1550 1500 1450 1400 1350 1300 1250 1200 1150 1100 1050 1000 950 900 850 800 750 700 650 600
I
II
I
II
GRADE 1.
GRADE 2.
GRADE 3.
GRADE 4.
GRADE 5.
P: Median value of maximum potential soil moisture deficit.
A: Lower quartile value of accumulated degree-days above 0°C for January-June (inclusive).
Classification limits (Grades 1-5)
Division Limits (Grades 3 & 4 only)
Grade 5 sub-limits (Scottish class limits)
+ Plotted example using data and key in Table 1.

Figure 1. Climatic Classification

Figure 2

Hourly mean speed in metres per second exceeded for 50% of the time during the years 1965 - 73. Valid for a height of 10 metres above open level terrain (gust ratio 1·60) and for altitudes between 0 and 70 metres above mean sea level.

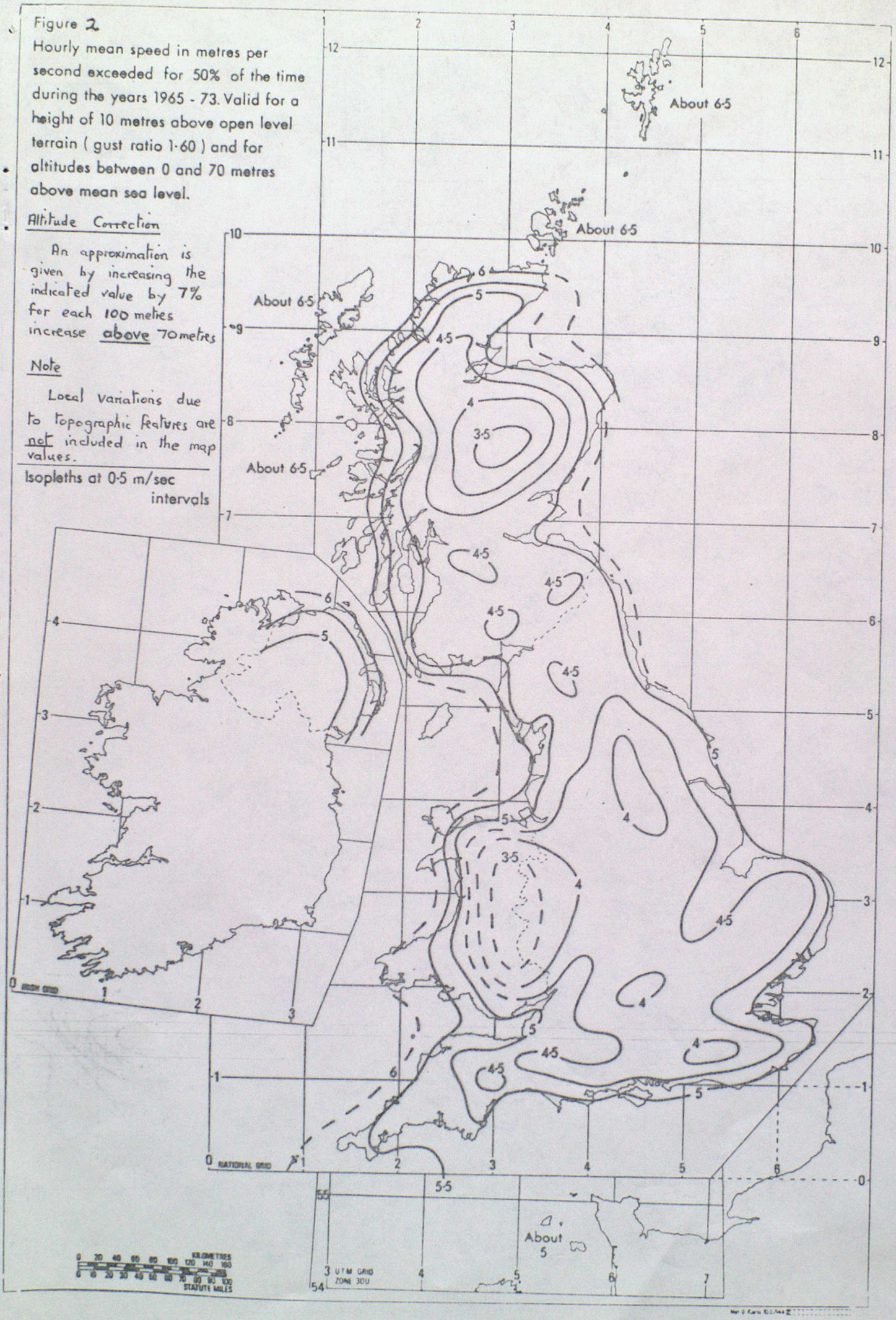
Altitude Correction

An approximation is given by increasing the indicated value by 7% for each 100 metres increase above 70 metres

Note

Local variations due to topographic features are not included in the map values.

Isopleths at 0·5 m/sec intervals



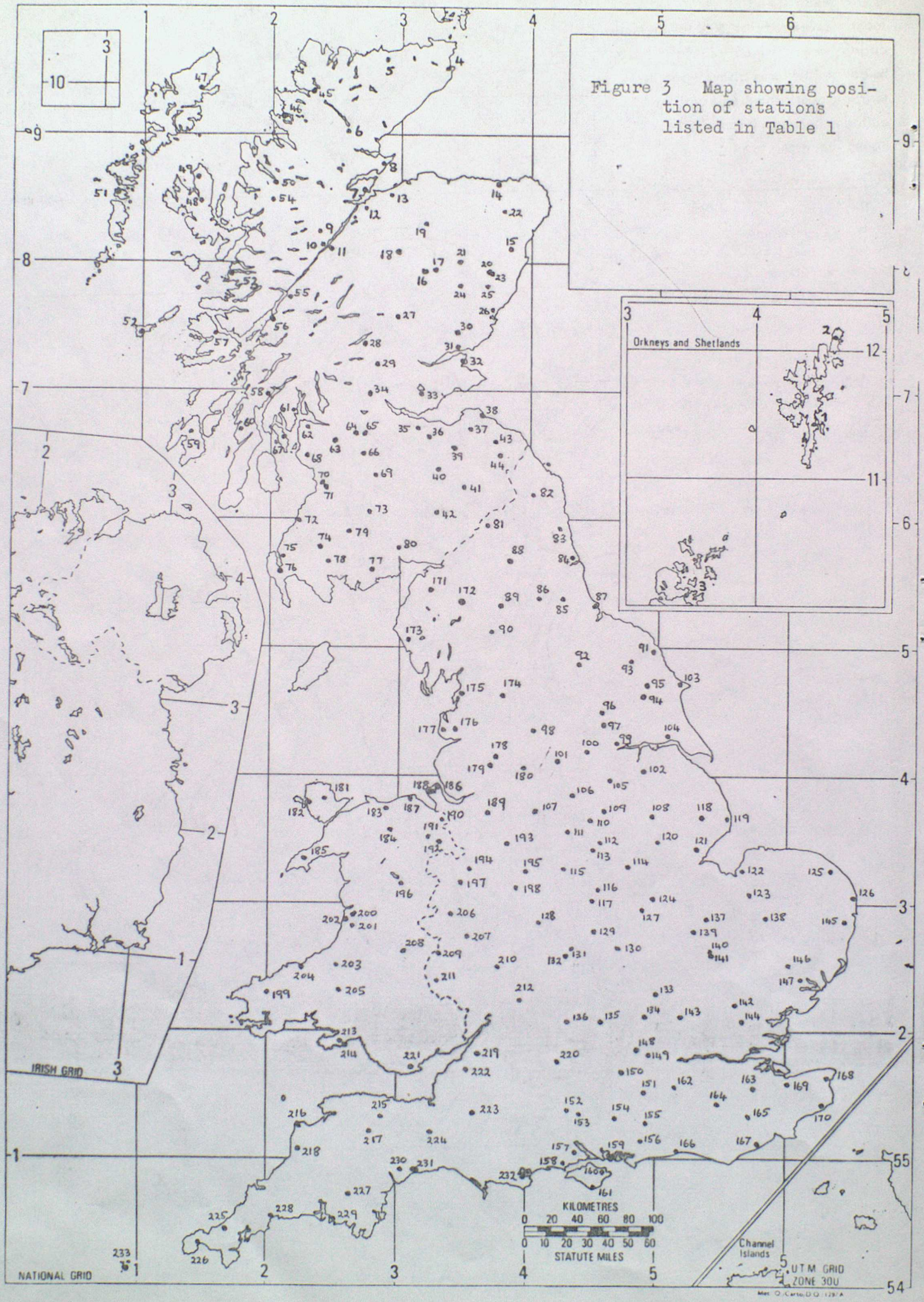


Figure 3 Map showing position of stations listed in Table 1

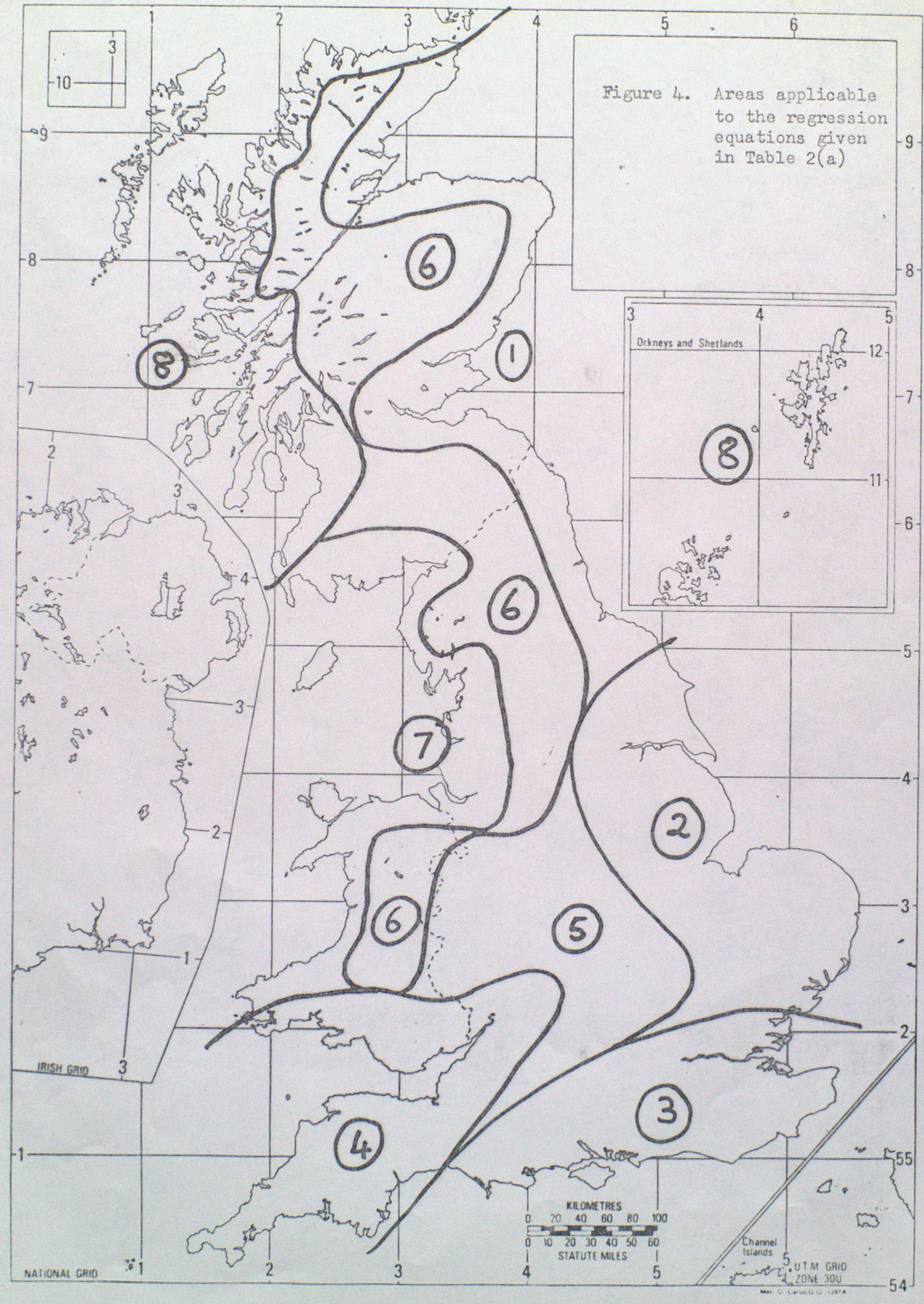


Figure 4. Areas applicable to the regression equations given in Table 2(a)